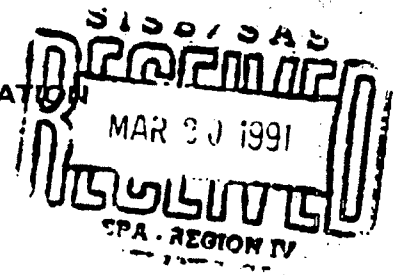




TENNESSEE DEPARTMENT OF CONSERVATION

Doctors Building  
706 Church Street  
Nashville, TN 37247-3801



March 19, 1991

Mr. Robert Morris  
State Project Officer  
Investigations & Compliance Section  
USEPA, Region IV  
345 Courtland Street  
Atlanta, GA 30365

Dear Mr. Morris:

Enclosed are Preliminary Assessment Reports on the Jeffrey Chain Corp. (TND not assigned) and Southern Oil Service, Inc. (TND not assigned) sites. Both of these sites are recommended for Screening Site Investigations, with a high priority recommended for the Jeffrey Chain Corp. site and a medium priority recommended for the Southern Oil Service, Inc. site.

Also enclosed are Screening Site Investigation Reports on the Ivan Miller/Roan Mountain (TND 981929276) and Jackson Pit Dump (TND 980709455) sites. Evaluation of both these sites under the Revised Hazard Ranking System is recommended, as significant HRS II scoring potential exists in both cases.

As usual, if you have any questions or comments, please call me.

Sincerely,

A handwritten signature in cursive script, appearing to read "Gordon".

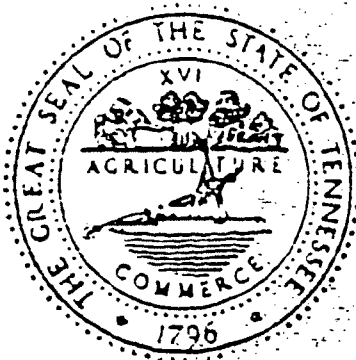
Gordon S. Caruthers  
Tennessee Division of Superfund

GSC/F3051078



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SSI-hig  
RKlein



# Potential Hazardous Waste Site

## PRELIMINARY ASSESSMENT

JEFFREY CHAIN CORPORATION

TND 987776952

---

Revision 0

Prepared By CHRIS ANDEL *CA*

Reviewed By *[Signature]*

Date MARCH 8, 1991

Date 3/11/91

*[Signature]*  
3/18/91

EXECUTIVE SUMMARY  
JEFFREY CHAIN CORPORATION  
TND

The Jeffrey Chain Corporation is located within the City of Morristown, Hamblen County, Tennessee. The site is located just off of Highway 11E, (Andrew Johnson Highway).

The Jeffrey Chain Corporation manufactures a variety of industrial use chains. For approximately 8 years, Jeffrey Chain and their predecessor, Dresser Industries Inc., disposed of liquid wastes containing hazardous substances in a small, unlined pit. The pit measures approximately 50 feet by 30 feet and is located about 100 feet from the southwest corner of the main building. Heavily contaminated soil has been excavated from the pit and stored on site. Monitoring wells have confirmed that the groundwater is grossly contaminated by total petroleum hydrocarbons and chlorinated organics, at least in the vicinity of the pit.

Based upon the results of this report, the Jeffrey Chain site has the potential to be placed on the National Priorities List. Potable wells in proximity to the site have been identified, but have not been sampled. In addition, HRS II factors relating to groundwater have been identified which may affect scoring. The site is recommended for a Site Screening Investigation to be completed by the Tennessee Division of Superfund in 1991.

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\*\* Projected HRS score was not completed due to the fact that no additional information is anticipated at this time which would significantly affect the score.

## JEFFREY CHAIN CORPORATION

TND

### NARRATIVE SUMMARY

#### 1.0 INTRODUCTION

Numerous site visits have been conducted at the Jeffrey Chain Corp. over the past two years. These visits were undertaken by the Divisions of Water Pollution Control, Solid Waste Management, and in particular Superfund, in an effort to evaluate the potential threat to human health and the environment existing due to improper disposal of hazardous substances on site. The results of the cumulative visits have been used to develop a preliminary assessment of the site and are the subject of this report.

#### 2.0 SITE CHARACTERIZATION

##### 2.1 Site Background and History

The Jeffrey Chain Corporation manufactures a variety of industrial use chains (Ref D11). The company has been headquartered at the Morristown location since 1985, when investors purchased the assets of the former Jeffrey Chain Division of Dresser Industries Inc., and formed the corporation (Ref D11, D31).

In June of 1988, the Tennessee Division of Water Pollution Control (DWPC) inspected the Morristown plant while investigating a complaint (Ref D12). Four areas of concern were discovered during the inspection, and a Notice of Noncompliance was subsequently issued to Jeffrey Chain by the DWPC (Ref D12). The first three areas were relatively minor and have been corrected by Jeffrey Chain. Please see Ref D12 and D31 for more detail on these problems. Area 4 however represented the greatest potential threat to human health and environment, and is the focus of Superfund's involvement with the site. Area 4 consists of a small gravel lined pit located south of the main building (Ref D12, D31, D13, D15). The pit was installed in 1979 by Dresser Industries to be used for disposal of cutting oils and grinding sludges (Ref D28, D31). The pit continued to be used by Jeffrey Chain after the 1985 buy-out for disposal of liquid wastes containing hazardous substances. Use of the pit ceased in 1988 upon demand by the DWPC (Ref D12, D13). Three hundred cubic yards of soil, heavily contaminated with petroleum hydrocarbons, were excavated in and around the pit (Ref D14, D22, D23, D31). The Division of Solid Waste Management became involved with the site since the contaminated soil presented a disposal problem.

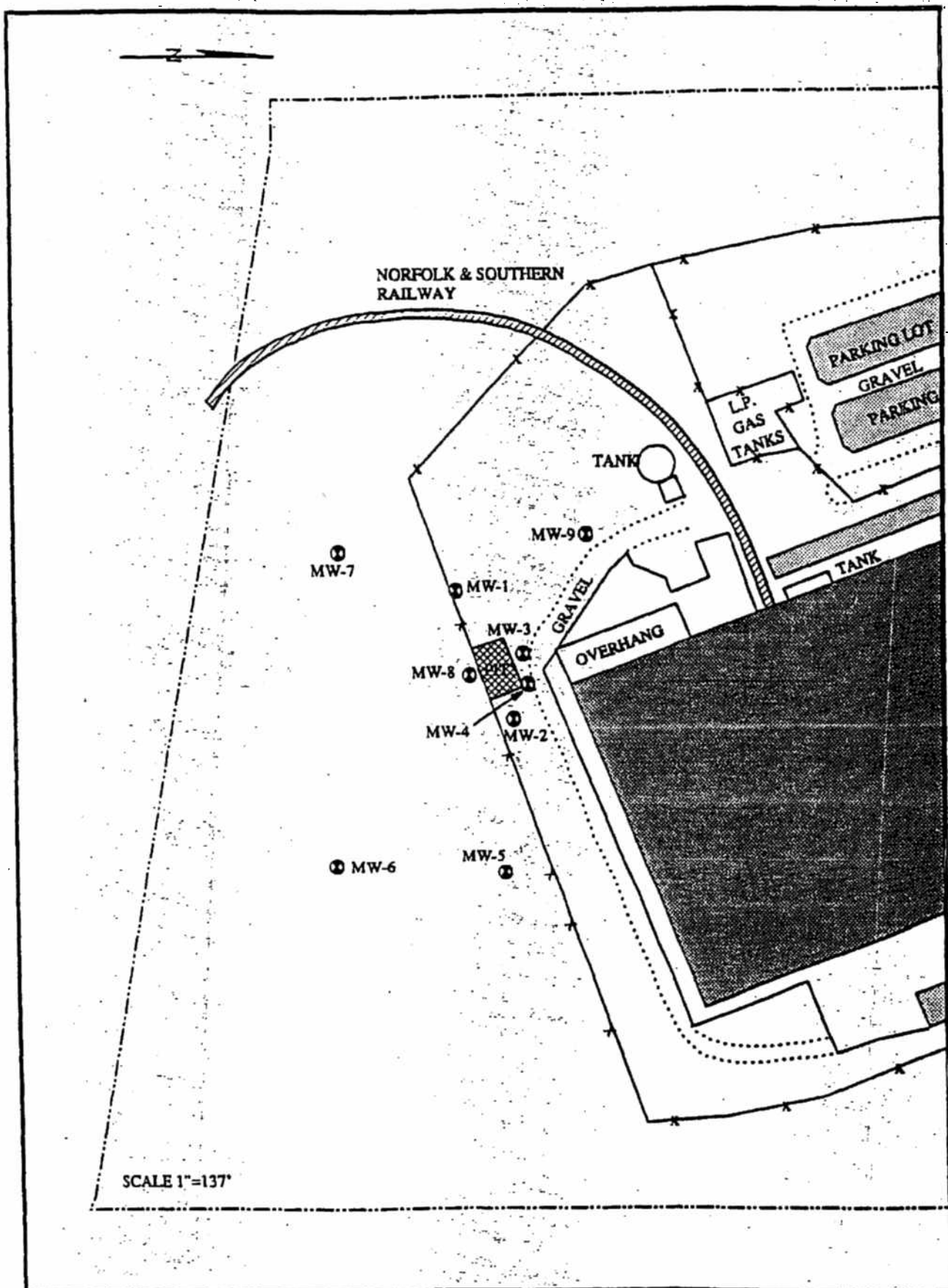
(Ref D15, D21, D22). After some deliberation, regulatory authority was passed to the Tennessee Division of Superfund (TDSF) since the disposal pit was no longer active (Ref D18, D19, D20, D21). Four monitoring wells were installed north of the pit under the direction of TDSF (Ref D24). Sampling revealed at least two separate phases of liquid waste lying on the water table as well as gross contamination of the groundwater by total petroleum hydrocarbons and chlorinated organics (Ref D23). Five additional wells were subsequently installed (see site map) south and east of the pit (Ref D29). These wells have also shown gross contamination, indicating that the plume is migrating offsite (Ref D29). Jeffrey Chain and their consultant believed that the contamination was minor and confined to an area immediately around the pit. Jeffrey Chain requested that the pit be removed from consideration as a Superfund site and contamination allowed to attenuate naturally (Ref D29, D31).

In June of 1990, TDSF brought the Jeffrey Chain Corp. before the Solid Waste Control Board in an effort to have the site promulgated and added to the State List of Inactive Hazardous Substance Sites. The Board voted against promulgation, stating that Jeffrey Chain did not meet criteria for listing. The Board maintained that, 1) the site is not inactive, and 2) the site does not represent a threat to human health or the environment. As required by State law, TDSF was no longer able to expend manhours overseeing any non-preremedial work on the site. Jeffrey Chain has proceeded for the last 6-8 months essentially unregulated.

## 2.2 Site Description

The Jeffrey Chain site consists of a small gravel lined pit, approximately 50 feet X 30 feet, located about 100 feet from the southwest corner of the main building (Ref D12, D24, D31). For a period of about 8 years, the pit was used to dispose of waste cutting oils and contaminated water generated by the chain making process. The liquid wastes were dumped directly into the pit and allowed to seep into the subsurface environment. According to Jeffrey Chain, the total quantity of liquid waste disposed of in this manner over the eight year period was approximately 21,000 gallons (Ref D28).

There is some speculation that the pit is located in conjunction with a sinkhole. This would provide a direct conduit to groundwater and allow for rapid evacuation of any liquid wastes disposed of in the pit. TDSF has obtained copies of all Material Safety Data Sheets (MSDS) for



WELL LOCATIONS  
JEFFREY CHAIN CORPORATION  
MORRISTOWN, TENNESSEE



chemicals handled by Jeffrey Chain. The MSDS's indicate that the company handles a wide array of hazardous chemicals, any of which could have been dumped into the pit.

### 2.3 Environmental/Regional Setting

The Jeffrey Chain Site is located within the city limits of Morristown, Tennessee, in Hamblen County. The site is situated in an industrial park in the southwest portion of the city (Ref App. A). There are no residences located adjacent to the property. Residences are located within one mile to the west and north. The main street through Morristown passes approximately 1/4 mile north of the site and is lined with small businesses and restaurants in the vicinity of Jeffrey Chain. The majority of property surrounding the site, east to south to west, is industrial or rural. There are no schools and three churches within one mile (Ref App. A). No critical habitats or endangered species are known to exist along the extended surface water migration pathway from the site (Ref D10).

### 2.4 Site Hydrology

The average net precipitation for the Morristown area is 10 inches. The one year/24 hour rainfall probability is 2.75 inches (Ref D8, D9).

The site is located in a karst region. Drainage in the vicinity of the site is characterized by sinkholes, karst windows, disappearing streams, and closed basins (Ref App. A). Surface expressions of drainage pathways around and from the site are somewhat limited. It is believed that any surface runoff from the area around the pit would flow south and southwest, in the direction of a karst plain which can be seen on the topographic map. This area is a closed basin and has no readily apparent surface outlet to any major surface water body.

### 2.5 Regional Aquifer Characteristics

The Jeffrey Chain site is underlain by Ordovician aged Mascot Dolomite, belonging to the Knox Group. The Mascot is described as a siliceous dolomite, light to medium gray, fine to medium grained, medium to thick bedded, and sparsely cherty. Pinkish mottled beds appear in the upper part and gray limestone beds are present locally. There is an erosional unconformity at the top. Thickness of the formation is as much as 600 feet in some places (Ref D2, D4). Groundwater is controlled by secondary fractures and solutionally enlarged openings. The Mascot has been



described as being highly competent and somewhat resistant to weathering (Ref D4). Due to the magnitude of structural deformation which has occurred in the area, secondary fractures in the Mascot can be quite large. For wells intersecting a large fracture zone, yields can be high. The Mascot is a reliable source of potable water in the region (Ref D4).

For the purpose of this exercise, the aquifer of concern is considered to be the Knox Group, undifferentiated. All formations within the Knox are lithologically similar (Ref D2, D4).

It would not be prudent to assume that water recharged within the Mascot in the vicinity of the site could not transcend formational boundaries.

### 3.0 TARGET ANALYSIS

There are four pathways that could potentially affect the surrounding population ; surface water, groundwater, air, and onsite exposure. The following table outlines the population potentially at risk from the four pathways.

<u>Migration Pathway</u>	<u>Population</u>
Surface Water	0
Groundwater	>10,000
Air	0
Onsite Exposure	0

The potential for contaminant migration and exposure via the air route was not evaluated, but is considered very remote. Population exposed via surface water was based on the potential for municipal water intakes to become adversely affected as a result of contaminants migrating offsite via surface water. As discussed earlier, surface runoff from the pit area would flow into a closed basin, with no apparent surface water outlet. Conversely, any surface runoff as well as hazardous substances disposed of in the pit, would most likely have direct access to groundwater resources in the area. Population exposed via groundwater was based on the potential for this resource to become contaminated as a result of waste disposal practices at Jeffrey Chain, and enter a potable supply. The entire Morristown population (1986 Census) of 19,100 was counted as being potentially at risk for the following reasons (Ref D36). Mr. Robert Garrett, Manager of the Morristown Utility Commission was contacted concerning the source of Morristown's municipal water. Mr. Garrett stated that approximately 35% of Morristown's supply is obtained from

Havely Spring, located approximately two miles NNE of the site. The remaining 65% is obtained from Cherokee Lake. Mr. Garrett also stated that a well is located at the corner of Jackson Street and Morris Blvd. which is used by citizens to fill up jugs, etc. for private use (Ref D34). The well is approximately 1.5 miles ENE of the site. Not knowing who, among the citizens of Morristown, regularly uses the well and who does not, it is plausible that any one citizen has the potential to be exposed at any given time if the well were contaminated. The Morristown Golf and Country Club, located less than one mile SSE of the Jeffrey Chain site, was contacted concerning the water supply seen on the topo map. A golf course employee confirmed that the well is used for irrigation purposes and is plumbed into the clubhouse for potable use (Ref D35). In addition, at least five private wells were discovered within one mile SSW of the site, which are used for potable supplies. For the purpose of this exercise, the aquifer of concern is considered to be the Knox Group undifferentiated, since the various formations within the Knox Group are lithologically similar, as previously discussed. There is also a large thrust fault located just north of the site. Since the fault transects primarily Knox Group formations, it was considered to have the potential to enhance groundwater/contaminant flow (Ref D2). Onsite exposure was based on the potential for non-workers to access the site and be directly exposed to contaminants. The site is fenced and guarded, sufficiently restricting access.

#### 4.0 FIELD INVESTIGATION

Field investigations to date have primarily amounted to site visits and some sampling. During the early history of the site, it was not clear under whose authority the site belonged. When the decision was made that Superfund had primacy, the groundwater assessment began to move forward. Since the site failed to be promulgated, Superfund no longer had authority to oversee RI/FS type work on the site. Regular site visits and contact with Jeffrey Chain ceased as of early June, 1990 until March, 1991.

Preliminary sampling by the Division of Superfund in 1989 detected the following compounds in the soil: ethylbenzene, toluene, xylene, chromium, and barium (Ref App. A). Subsequent sampling of the monitoring wells by Tenera detected additional compounds as follows: 1,1,1 trichloroethane, 1,2 dichloroethene, and tetrachloroethane (Ref D24, D29).

The site was revisited March 3, 1991 in order to take

photographs for the PA. According to Jeffrey Chain and their consultant, approximately 3000 cubic yards of contaminated soil have been excavated and additional monitoring wells have been installed. Detailed review of this latest information has not been completed and is beyond the scope of this report.

## 5.0 Summary

Field investigation and sampling of the Jeffrey Chain site by the Division of Superfund and Tenera have determined that hazardous substances are present and have negatively impacted groundwater resources.

The four mile radius of concern is served by municipal utilities. A small isolated area located less than one mile SW of the site has been identified which relies completely on wells for their potable water, with no alternate supply readily available. The Morristown Golf and Country Club utilizes a well for irrigation and potable water which is 700 feet deep. In all likelihood the well was drilled deep to increase storage capacity and has not been cased to exclude shallow groundwater. In addition, the city of Morristown relies on groundwater (Havely Spring) for a portion of their municipal supply. This is mixed with surface water obtained from Cherokee Lake and treated at the filtration plant.

Based upon the results of this investigation, the Jeffrey Chain site has the potential to be placed on the National Priority List. Groundwater contamination has been confirmed at the site. Investigation has determined that a large population within the four mile radius of concern relies upon groundwater for a portion of their potable supply. In addition, HRS II concerns have been identified which may affect the score. The Jeffrey Chain site is recommended for a Site Screening Investigation to further evaluate NPL potential.





Reviewed and approved.  
May 5/10/04

August 16, 2002

Mr. Lofton Carr  
Remedial Project Manager  
U.S. Environmental Protection Agency  
61 Forsyth Street, SW 11<sup>th</sup> Floor  
Atlanta, Georgia 30303

SITE: Jeffrey Chain  
BREAK: 1.8  
OTHER: V2

Subject: Reassessment Report  
Jeffrey Chain Corporation  
EPA ID No. TND987776952  
EPA Contract No. 68-S4-01-01 (STAT 4)  
Task Order No. 0007

Dear Mr. Carr:

The T N & Associates, Inc. (TN&A) Superfund Technical Assessment Team (STAT) is submitting the reassessment report, scoresheets, and confidential pages for the Jeffrey Chain Corporation site in Morristown, Hamblen County, Tennessee. The CERCLA Eligibility form, all references cited, and the original topographic maps are also enclosed. Please review the report and provide comments to be included in subsequent revisions to the report.

Please contact me or Matt Ellender at (678) 355-5550 if you have any questions regarding this report.

Sincerely,

A handwritten signature in black ink, appearing to read 'Gregory J. Kowalski'.

Gregory J. Kowalski  
STAT Project Manager

Enclosure

CC: Anita Wender, EPA Contracting Officer (w/o enclosure)  
Cindy Gurley, EPA Task Order Project Officer (w/o enclosure)  
Stacy Hill, EPA Contract Specialist (w/o enclosure)

# **REASSESSMENT REPORT**

**JEFFREY CHAIN CORPORATION  
MORRISTOWN, HAMBLLEN COUNTY, TENNESSEE  
U.S. EPA ID No. TND987776952**

**Revision 0**

**Prepared for:**

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
Region 4  
61 Forsyth Street  
Atlanta, Georgia 30303**

**Prepared by:**

**T N & Associates, Inc.  
840 Kennesaw Avenue, Suite 7  
Marietta, Georgia 30060**

Contract No.	:	68-S4-01-01
Task Order No.	:	0007
Date Submitted	:	August 16, 2002
EPA Task Monitor	:	Loften Carr
Telephone No.	:	404-562-8923
Prepared by	:	PJ Ashford
Telephone No.	:	678-355-5550

# CERCLA Eligibility Form

Site Name: Jeffrey Chain Corporation

City/County/State: Morristown, Hamblen County, Tennessee

EPA ID Number: TND987776952

Type of Facility:	Generator <u>X</u>	Transporter <u>    </u>	Disposal <u>    </u>
	Treatment <u>    </u>	Storage <u>    </u>	Landfill <u>    </u>

	Yes	No
--	-----	----

Has this facility treated, stored, or disposed of a RCRA hazardous waste since Nov. 19, 1980?	<u>    </u>	<u>X</u>
---	-------------	----------

Has a RCRA Facility Assessment (RFA) been performed on this site?	<u>    </u>	<u>X</u>
---	-------------	----------

Does the facility have a RCRA operating or post-closure permit? If so, date issued:	<u>    </u>	<u>X</u>
--	-------------	----------

Did the facility file a RCRA Part A application?	<u>    </u>	<u>X</u>
--	-------------	----------

If so:

- |  |             |             |
|--|-------------|-------------|
| 1) Does the facility currently have interim status?      | <u>    </u> | <u>    </u> |
| 2) Did the facility withdraw its interim status?         | <u>    </u> | <u>    </u> |
| 3) Is the facility a known or possible protective filer? | <u>    </u> | <u>    </u> |

Is the facility a late (after Nov. 19, 1980) or non-filer that has been identified by EPA or the State?	<u>    </u>	<u>X</u>
---	-------------	----------

Is the site a Federal Facility?	<u>    </u>	<u>X</u>
---------------------------------	-------------	----------

Is there at least one source on site, which is not covered by CERCLA Petroleum Exclusion Legislation?	<u>X</u>	<u>    </u>
---	----------	-------------

Is the facility owned by an entity that has filed for bankruptcy under Federal or State laws?	<u>    </u>	<u>X</u>
---	-------------	----------

Has the facility lost authorization to operate or had its interim status revoked?	<u>    </u>	<u>X</u>
---	-------------	----------

Has the facility been involved in any other RCRA enforcement action?	<u>    </u>	<u>X</u>
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### Attachment

A 1990–1996 Groundwater Monitoring Analytical Data .....	
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## **1.0 INTRODUCTION**

The U.S. Environmental Protection Agency (EPA) has tasked the T N & Associates, Inc., (TN&A) Superfund Technical Assessment Team (STAT) to perform site reassessments under Contract Number (No.) 68-S4-01-01. Reassessments are conducted to evaluate a site's current Hazard Ranking System (HRS) status, document what is contained within the site files, update target information, generate a new site score, and summarize all the information in a report submitted to EPA. This Reassessment Report has been prepared in accordance with the scope of work requirements of Task Order No. 0007, for the Jeffrey Chain Corporation (Jeffrey Chain) site, EPA Identification (ID) No. TND987776952, located in Morristown, Hamblen County, Tennessee. This Reassessment Report evaluates Jeffrey Chain based on files provided by EPA and the Tennessee Department of Environment and Conservation (TDEC).

## **2.0 SITE BACKGROUND**

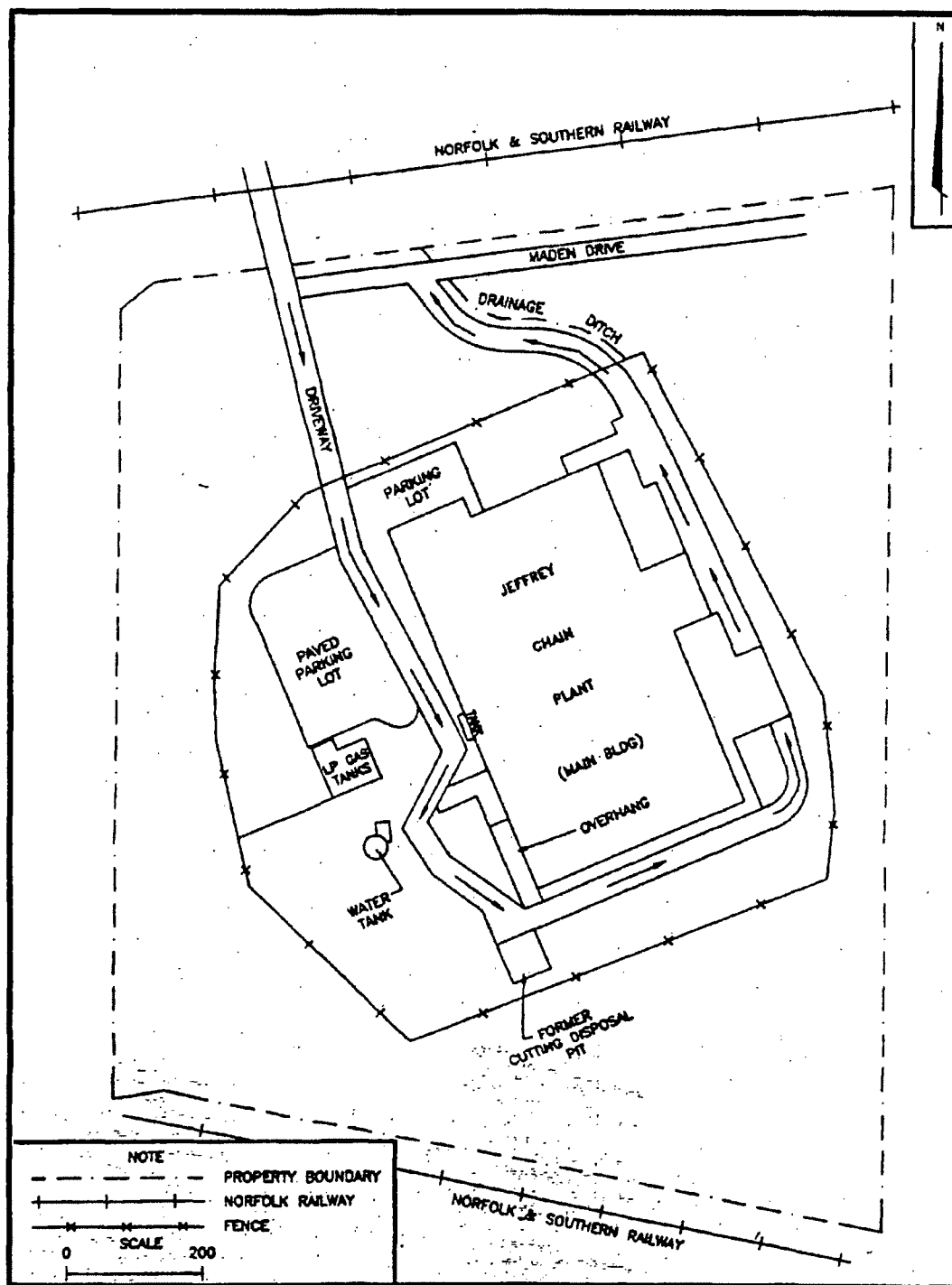
This section describes the site and its present and past operations (including waste disposal practices and regulatory history), the environmental setting and geology, previous investigations, and the source areas located at the facility.

### **2.1 SITE DESCRIPTION**

Jeffrey Chain is located on a 30-acre parcel of land at 2307 Maden Drive, Morristown, Hamblen County, Tennessee (see Figure 1) (Refs. 1, 2). The site's geographic coordinates are 36° 12' 05" north latitude and 83° 19' 20" west longitude (Ref. 1). The site is situated at the western end of the main commercial areas of Morristown. It is surrounded by open land to the south and west and industrial facilities to the east and north (Refs. 1; 3, p. 5). Since the original construction of the plant in 1961, the facility has been used to manufacture a variety of industrial use chains, including engineer-class conveyor-type chains (Ref. 2, p. 2-10). Jeffrey Chain remains active and continues to manufacture industrial conveyor-type chain (Ref. 4).

The site consists of a main building, two parking lots (north and west), a water tank (for fire prevention), liquid petroleum gas tanks, and a substation on the property (see Figure 2) (Refs. 3; 5, p. 2). A former gravel-lined disposal pit located on the southwestern corner of the facility was used for the disposal of approximately 21,000 gallons of cutting oils and grinding sludges (Refs. 2; 3, pp. 2, 12). The





JEFFREY CHAIN CORPORATION  
 EPA ID No. TND987776952  
 Morristown, Hamblen County, Tennessee

FIGURE 2 - SITE DIAGRAM

**TN & A** T N & Associates, Inc.  
 Engineering and Science

Copied from Black & Veatch Waste Science, Inc.,  
 Site Inspection Report. September 6, 1994.

gravel and soil in the pit were excavated, and they are now covered with asphalt (Refs. 2, p. 2-11; 5, pp. 5, 6). A drainage ditch runs along the rear of the property to the front (Ref. 5, p. 14). The ditch ends at Maden Drive. Formerly, Norfolk & Southern Railway tracks abutted the main facility to the southwest; however, sometime in the mid-1990s the tracks were removed. Southern Railway tracks continue to border the site to the north and south. An industrial facility exists to the east and an open field lies to the west.

### **2.1.1 Site History**

Throughout its history, several owner/operators have occupied the premises. The first owner of the site was Jeffrey-Gallion (Ref. 2, p. 2-10). Dresser Industries, Inc. (Dresser) purchased the plant in 1974 and operated it until 1985. In 1985, investors purchased the assets of the Jeffrey Chain Division of Dresser and formed the Jeffrey Chain Corporation (Ref. 3, p. 2). According to the Jeffrey Chain website, Renold of the United Kingdom purchased the company in 2000, but it is still operated by Jeffrey Chain (Ref. 4).

On June 22, 1988, an anonymous complaint alleged that Jeffrey Chain dumped wastes in a pit behind the facility using tanker trucks (Ref. 6). A follow-up inspection by the Tennessee Division of Water Pollution Control (DWPC) identified four areas of environmental concern, including a disposal pit on the southwestern corner of the site (Ref. 7). Dresser installed the 50 foot × 30 foot pit in 1979 (Ref. 3, pp. 2, 3). Originally, the pit may have been a sinkhole that allowed a direct connection to groundwater and rapid evacuation of liquid wastes (Ref. 3, p. 3). The facility used the pit to dump waste cutting oil, grinding sludge, and smaller amounts of other wastes from the facility (Ref. 3, p. 2). Jeffrey Chain was ordered to cease all unpermitted discharges, and use of the pit stopped in 1988 (Ref. 3, p. 2). Groundwater sampling has identified aluminum, barium, chromium, iron, lead, manganese, nickel, potassium, sodium, vanadium, zinc, cis-1,2-dichloroethene (cis-1,2-DCE), and xylene, suggesting that these wastes were also dumped into the pit (Ref. 5, Tables 8 and 9). An estimated 21,000 gallons of wastes were dumped into the pit over a period of 8 years (Ref. 3, p. 3).

Jeffrey Chain excavated approximately 300 cubic yards (yd<sup>3</sup>) of heavily contaminated soil in the pit and started passive remediation for removal of oil in the groundwater (Ref. 3, p. 2). An area beneath the main facility could not be excavated because it would have affected the stability of the soils supporting the building (Ref. 8, p. 2-1). This area contained levels of total petroleum hydrocarbons (TPHs) above Tennessee guidance levels.

A 1994 Site Inspection (SI) conducted by Black & Veatch Waste Science, Inc. (B&V), identified elevated levels of barium, calcium, copper, lead, magnesium, manganese, nickel, sodium, zinc, bis (2-ethylhexyl) phthalate, and acetone in surface soil samples from a drainage ditch (Ref. 5, Tables 3 and 4). Elevated concentrations are defined as meeting or exceeding three times a background concentration, or meeting or exceeding the detection limit of a non-detect background result. The contamination was located in a drainage ditch in the front of the facility.

As reported in the August 1996 Summary Report, all levels of TPH contaminants in soil and groundwater were below Tennessee guidance values. In 1997, TDEC concluded that no further action at the site was required regarding affected soils (Refs. 9, 10). Elevated concentrations of contaminants may still remain on site; however, no subsequent sampling events after 1997 were documented in the site file.

### **2.1.2 Regulatory History**

According to a summary of site information prepared for Jeffrey Chain by Strata Environmental (Strata), the facility was a large-quantity generator until January 1992 (Ref. 11, p. 2-5). At this time, Jeffrey Chain had sufficiently reduced the amount of hazardous waste it generated to change its status to a small-quantity generator.

On June 22, 1988, an anonymous complaint was filed against Jeffrey Chain for dumping wastes (Ref. 6). Five days later, the Tennessee Department of Health and Environment (TDHE)–DWPC issued Jeffrey Chain a Notice of Violation (NOV) for illegally discharging industrial wastes (Refs. 7, 12 p. 2). The NOV identified four areas of concern and requested a report on the hazardous compounds that could be present in this area. Jeffrey Chain complied with TDHE's request and began assessing the areas (Ref. 12).

On March 29, 1989, a letter to Jeffrey Chain consultants from TDEC stated that assessment activities identified ethylbenzene at 2,916 parts per billion (ppb) in a water/oil mixture present at the bottom of the excavated disposal pit (Refs. 7, 13). The letter also stated that TDHE was placing Jeffrey Chain on the State Master List of Potential Hazardous Substance Sites (Ref. 13).

On June 6, 1990, Jeffrey Chain appeared before the Tennessee Division of Superfund (TDSF), Solid Waste Control Board to oppose the proposed listing (Ref. 13). The TDSF board decided not to list Jeffrey Chain, stating that the site was still active and did not pose a threat (Refs. 3, p. 3; 13). The board

determined that listing Jeffrey Chain would have adverse effects on the company. Even without listing it, TDHE retained regulatory power and could still oversee cleanups and recover investigative costs (Ref. 13, pp. 9–10).

In August 1990, the Tennessee Attorney General issued an opinion stating that TDSF “was no longer able to expend manhours overseeing any non-preremedial work on the site (Refs. 3, p. 3; 14).” Essentially, no state oversight occurred at Jeffrey Chain until February 1994, when TDEC issued an NOV for (1) failing to label all hazardous waste containers, (2) failing to notify TDEC that it was generating a new hazardous waste (crushed fluorescent light tubes), and (3) not posting the name and telephone number of the plant emergency coordinator next to the telephone nearest to the used mineral spirits accumulation area (Ref. 15).

In a letter dated January 5, 1996, TDEC notified Jeffrey Chain that the primary responsibility for regulatory oversight was transferred to the TDEC State Remediation Section of the Division of Solid Waste Management (DSWM) (Ref. 16). In a February 29, 1996, letter from Strata to DSWM on behalf of Jeffrey Chain, a summary of corrective actions was provided. These accomplishments included a source removal, affected area closure, groundwater monitoring, and petroleum product recovery (Ref. 16).

On March 7, 1997, TDEC issued a Remedial Action Notice to Jeffrey Chain requiring the development of a remediation plan for the site that required the assessment of both soil and groundwater (Ref. 17). However, another March 7, 1997, TDEC letter stated that DSWM had concluded that no further action was required for affected soils at the facility. Since Jeffrey Chain had previously satisfied the requirement for assessing soil the letter stated, only the groundwater assessment plan was required (Ref. 9).

After submittal of the required documents, a letter to Jeffrey Chain from TDEC dated May 27, 1997, stated that DSWM had “determined that no further action was required with regard to contamination stemming from the former use of a water-soluble cutting oil sump on site” (Ref. 10). No federal- or state-level oversight is documented as having occurred after May 1997.

## **2.2 ENVIRONMENTAL SETTING AND GEOLOGY**

The climate in Hamblen County is temperate, characterized by warm summers and moderate winters (Ref. 18). The average winter temperature is 40.3°F with average lows near 27.7°F. The lowest recorded

temperature was -23°F in 1985. During the summer months, the average temperature is 73.3°F with an average daily maximum of 84.7°F (Ref. 18). The average annual rainfall for the area is 44 inches, with the heaviest rainfalls occurring during May and July (Ref. 18). The mean annual lake evaporation in this area is 34 inches, yielding an annual net precipitation of 10 inches (Ref. 19). The 2-year, 24-hour rainfall event for the area is approximately 3.5 inches (Ref. 20).

Hamblen County is located in the Valley and Ridge physiographic province (Ref. 21, p. 177). This province is characterized by ridges composed of less soluble cherty limestone, dolomite, and sandy shale and valleys composed of more soluble limestone, dolomite, and shale (Ref. 21, p. 6). Most of the ridges in this region run parallel to each other from the southwest to the northeast (Ref. 21, p. 6). The Blue Ridge province to the west and the Appalachian Plateau province to the east border the Valley and Ridge. Hamblen County's land surface has high relief characterized by alternating valleys and ridges. The highest elevations in Hamblen County occur on the ridges with the highest elevation being approximately 2,000 feet above mean sea level (msl) (Ref. 21, p. 177). The lower elevations occur in the valleys and are normally around 1,110 feet above msl (Ref. 1). The lowest point in the Morristown area is the Holston River at 980 feet above msl (Ref. 1).

The oldest geologic formation in Hamblen County is the Rome formation of the Cambrian age (Ref. 21, p. 178). Stone Mountain, which lies in the extreme northeastern corner of the county, is underlain by this formation. The Rome formation is a 700-foot thick-layer comprised of two members; the first is a sandstone-bearing member that contains varicolored shale, siltstone, and sandstone, and the second is an apison shale member made up of bright red-and-green shale. Because groundwater occurs in closely spaced joints only, this formation yields small amounts of water from groundwater wells. The sandstone member is a more productive aquifer than the shale. The youngest exposed formation in Hamblen County is the Sevier shale from the Middle Ordovician age. This layer is composed of the first and second unit of the lower and middle parts of the Chickamauga limestone. The second unit contains the Ottosee shale, a bluish calcareous shale layer containing crystalline limestone lenses. The Holston, Lenoir limestone and Athens shale formations compose the first unit of the Chickamauga limestone. The Holston formation has red- and quartzose-crystalline limestone and limy sandstone. The Lenoir contains blue nodular and massive limestone. The Athens formation is characterized by blue calcareous shale with sandstone beds and blue limestone at its base. The limestone in this formation yields small to moderate quantities of groundwater. The shale layers generally produce larger quantities of water (Ref. 21, p. 12). The formations that occur between the Rome formation and Sevier shale are discussed below from youngest to oldest.

The first layer is the Knox group of the Lower Ordovician series containing the Newals, Longview, Chepultepec, and Copper Ridge dolomite, as well as the Conococheague limestone formations. The first three formations consist of siliceous dolomite with remaining formations containing dark, crystalline, siliceous dolomite and limestone. Water occurs in joints and solution channels and can yield large supplies of water to wells if a cavity is found. Large springs are found in these rocks. The Conasauga group of the Middle and Upper Cambrian series consists of alternating green shale and blue limestone layers. The limestone layers can yield large quantities of water. At the limestone/shale interface, water is commonly found. The shale layer yields small amounts of water. The Pumpkin Valley shale, the formation directly above the Rome formation, is a very poor aquifer (Ref. 21, pp. 11-12).

The aquifers of the Valley and Ridge province are usually located under the valleys only and are directly connected to a source of recharge, such as a river or lake (Ref. 22). These aquifers are not widely used for groundwater in the Morristown area. The majority of Hamblen County obtains water from surface water intakes. In some areas of the county where municipal water lines are not present, private potable drinking water wells are used.

The main source of recharge for the Valley and Ridge aquifers is surface water bodies (Ref. 22). Groundwater occurs primarily in areas directly connected to sources of recharge, such as rivers and lakes. Water is stored and can move through fractures, bedding planes, and solution openings in rocks. In areas with large numbers of solution cavities, groundwater can move rapidly. Groundwater movement in this aquifer is generally from the areas of elevation (ridges) to the low-lying areas (valleys). Some groundwater travels large distances and discharges to springs or streams (Ref. 22).

In general, Hamblen County can be divided into three distinct topographic belts. The first lies along the northwestern boundary of the county, and its width is only 2 miles across. Steep, sharply pointed, symmetrical hills and ridges underlain by shale and limestone from the Conasauga group of the Upper Cambrian and the Maryville limestone of the Middle Cambrian characterize the belt. The second belt is broader, consisting of rolling hills through the middle of the county. Underlying this belt is the cherty limestone and dolomite of the Knox group. In this area, sinkholes are common, and surface water drainage occurs mainly through cavities in the bedrock. The Sevier shale of the Middle Ordovician age underlies the third belt, which occurs along the southeastern border of the county. Similar to the first belt, it is characterized by sharply pointed, symmetrical hill and narrow ridges (Ref. 21, pp. 177-178).



The ground surface at Jeffrey Chain is approximately 1,340 feet above msl (Ref. 1). Surface water drainage at the site is channeled by a drainage ditch running from the rear of the facility to the front along the eastern side of the building. This discharges to a sinkhole across the street (Ref. 2, p. 3-7).

Four surface water drainage basins occur in the Morristown area. To the northwest lies the first drainage basin. It is bounded to the southeast by Crockett Ridge and drains to Cherokee Lake through an unnamed stream. The basin shows a classic dendritic drainage pattern, and the area does not contain features characteristic of karst terrain. The second drainage basin, which encompasses the majority of Morristown is primarily dendritic, but karst features are also present. Water drains to the northeast via Turkey Creek and Spring Branch to Cherokee Lake. This basin is bounded to the southeast by Bays Mountain. The third drainage basin includes Jeffrey Chain and extends to the southwest. This area is characterized by karst terrain and has no surface drainage stream out of the basin. Surface water generally percolates to the groundwater. The fourth area is located southeast of Bays Mountain and exhibits primarily dendritic to trellis type drainage. Karst features are not present in this area (Ref. 2, pp. 2-5-2-8).

## **2.3 PREVIOUS RELEASES AND INVESTIGATIONS**

Due to the large number of investigations that have occurred at Jeffrey Chain, the following list provides a chronological account of site events and a detailed description of significant investigations.

### **2.3.1 Chronological List of Site Events**

- |                      |  |
|----------------------|--|
| <b>June 22, 1988</b> | An anonymous complaint to TDHE, DWPC, alleged that wastes from Jeffrey Chain were being dumped behind the company by a tanker truck (Ref. 6).  |
| <b>June 24, 1988</b> | DWPC inspected Jeffrey Chain. The inspection found illegal discharges of industrial wastes. TDHE noted four areas of contamination including (1) a discharge of contaminants from an underground storage tank (UST) on to the front lawn of the facility, (2) a discharge of cooling water that contacted heat-treated metals in the process onto the front yard, (3) a discharge of an oily substance from a storage bin to the ground surface at the west side of the facility, and (4) an oily discharge of a coolant from a portable tank into a sump that drains to a gravel-lined pit at the southwestern edge of the facility (Ref. 7). |
| <b>June 27, 1988</b> | TDHE issued a NOV to Jeffrey Chain for the illegal discharges of industrial wastes outlined in the June 24, 1988, inspection. The NOV stated that all unpermitted discharges were to cease, that a report of the waste streams generated at the facility would be prepared, and that contaminated soils discovered during the inspection would be characterized (Ref. 7).  |

- August 3, 1988** Jeffrey Chain's lawyers, Watson, Reeves & Beeler, prepared a letter in response to the June 27, 1988, NOV. The letter stated that the three areas excluding the gravel pit area would be addressed and were not a problem (Ref. 23, p. 1). According to Jeffrey Chain, the gravel pit (described as Area 4) received approximately 500 gallons of a water-soluble waste oil solution every 4-6 weeks (Ref. 23, p. 2).
- November 9, 1988** Jeffrey Chain and TDHE met on November 7, 1988, to discuss cleaning up the site. A letter from TDHE summarized the decisions reached. With respect to Areas 1 and 2, the solid waste would be removed and sent to an appropriately designated landfill. Area 3 would be excavated, and the soils would be allowed to drain the oil they contained. This oil would then be sent off for recycling. These soils could then be disposed of appropriately. TDHE was awaiting analysis of soil samples from Area 4 (Ref. 24).
- February 23, 1989** A letter with this date stated that results from sampling at Jeffrey Chain identified the liquid in the pit (Area 4) as a hazardous substance that contained 2,916 ppb of ethylbenzene and a level of TPH above the Tennessee guidelines for total hydrocarbons in soil. The letter reported that TDEC had no data to indicate that ethylbenzene would be present in the cutting oil allegedly discharged to the disposal pit. Since on-site contamination was not gasoline or diesel related, TDEC pursued placing Jeffrey Chain on the Tennessee Superfund list (Ref. 25).
- November 1989** Soils adjacent to the southeastern portion of the facility were excavated and mixed with kiln dust at the facility to immobilize the residual oil. Jeffrey Chain excavated approximately 1,167 yd<sup>3</sup> of contaminated soil; 1,060 yd<sup>3</sup> came from Area 3, and 107 yd<sup>3</sup> of soil originated from Area 4 (Ref. 26, p. 2-1). The affected soil was stored on site on plastic pending an approved method of disposal.
- May 1990** A *Phase II Groundwater Investigation* identified 1,2-DCE, xylene, toluene, tetrachloroethene (PCE), and 1,1,1-trichloroethane (1,1,1-TCA) in groundwater (Ref. 27, p. 7-4).
- June 6, 1990** The State Board of Solid Waste Disposal Control heard arguments for and against listing Jeffrey Chain on the List of Inactive Hazardous Substance Sites. The board voted against listing (Ref. 12).
- December 1990** Jeffrey Chain excavated additional areas of soil impacted by dumping waste cutting oil. Soils were stockpiled on site prior to being treated. A total of 553.71 tons (approximately 450 yd<sup>3</sup>) of soil was removed. The final excavation area measured 60 feet x 60 feet and was 35 feet deep (Ref. 28, p. 3-6). The area of excavation was larger than that of contaminated soil because maintaining the stability of the pit walls required a slope of 2 to 1. A small area of soil underneath the Jeffrey Chain facility was not removed, although it contained elevated levels of TPH, because removal would have affected the ability of the soil to support the facility (Ref. 8, p. 2-1). A total of 2,500 yd<sup>3</sup> of soil were permanently removed from the site, according to Jeffrey Chain (Ref. 2, p. 2-11).
- March 8, 1991** TDEC performed a Preliminary Assessment (PA) at Jeffrey Chain. The PA recommended further investigation at Jeffrey Chain because of the threat it posed to groundwater. More details are provided in Section 2.3.2.

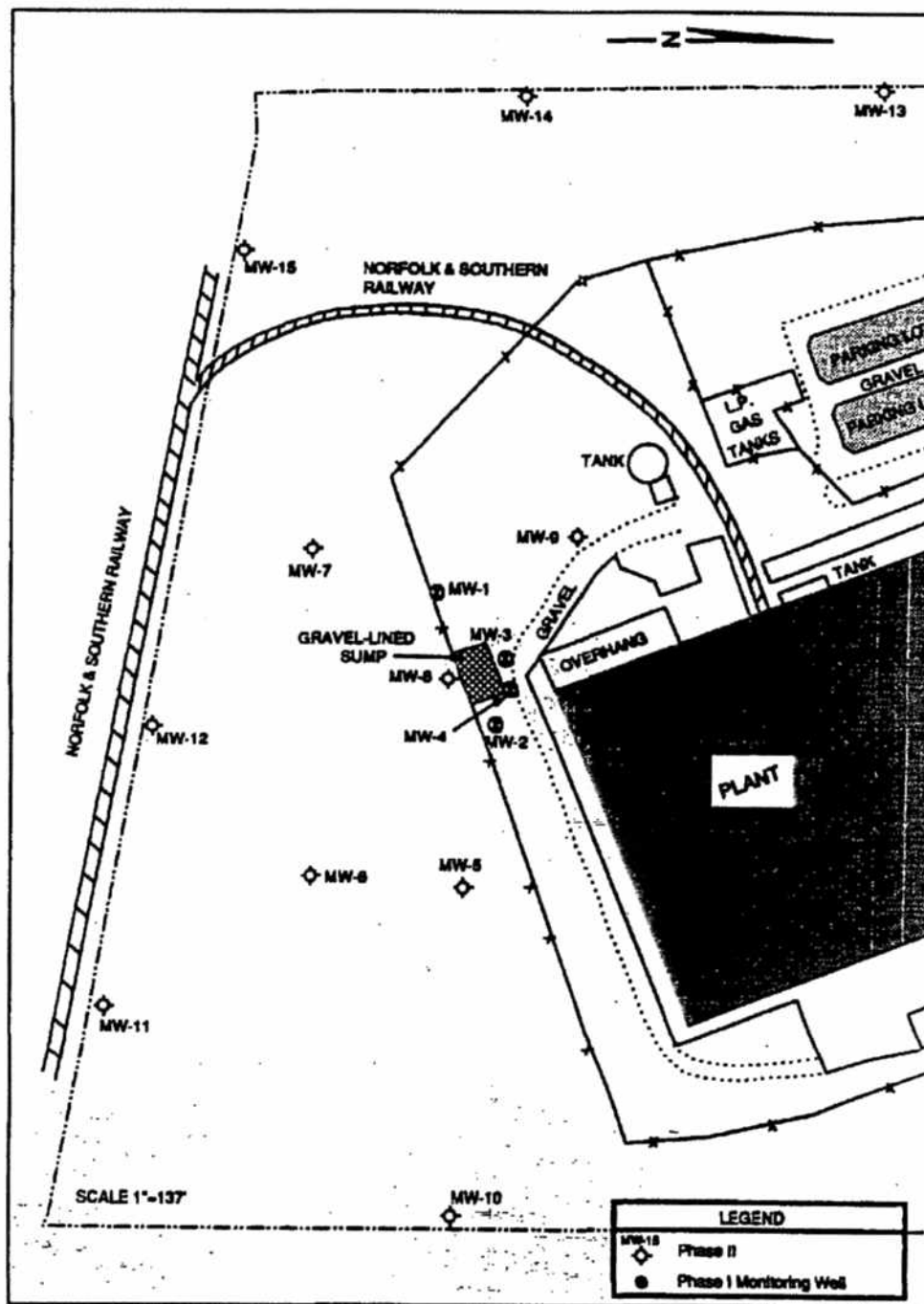
- March 1991** Tenera completed a *Groundwater Monitoring report* for the site. Water quality data were presented for 15 monitoring wells in 1990. Several hazardous compounds were identified at elevated levels compared to EPA National Primary Drinking Water Standards Maximum Contaminant Limit (MCL) (Ref. 29, Appendix A). The report is discussed further in Section 2.3.2.
- May 11, 1991** The excavated disposal pit area was backfilled with soil from another area on site (Ref. 11, p. 2-4).
- May 22, 1991** Jeffrey Chain completed construction of an asphalt cover for the backfilled former disposal pit (Ref. 11, p. 2-4).
- May 22, 1991** Stockpiled soils were shipped to Domermuth Environmental Services in Knoxville, Tennessee, for processing through a thermal treatment system. The soils removed in December 1990 were used as daily cover at the Waste Management, Inc.-operated landfill in Knox County, Tennessee (Ref. 2, p. 2-11).
- May 29, 1991** A Site Screening Inspection (SSI) scheduled for June 1991 was cancelled because the new HRS scoring system failed to show that Jeffrey Chain was a threat, based on the target values for the site (Ref. 30).
- September 6, 1994** B&V completed an SI for the site. The report concluded that soil and groundwater contamination from 1,2-DCE, xylene, and numerous inorganic compounds were present and the site needed further assessment. More details are provided in Section 2.3.2.
- March 3, 1995** Jeffrey Chain initiated a water-soluble oil recovery system to remove oil in the groundwater (Ref. 11, p. 2-6).
- April 1995** Strata prepared a *Site Inspection Evaluation* rebutting the SI. Strata claimed that B&V incorrectly concluded that further action was warranted at Jeffrey Chain (Ref. 2, p. 4-1).
- April 1, 1997** In a letter to TDEC, Strata revealed that, since the groundwater underneath Jeffrey Chain was considered to be a non-drinking water supply, the cleanup standards would be the Tennessee UST Division soil and groundwater standards. These standards were 500 parts per million (ppm) TPH for soil and 1 ppm TPH for groundwater (Ref. 31).
- March 7, 1997** TDEC concluded that no further action was required for soil at Jeffrey Chain. The decision was based on the level of TPH soil contamination being below the UST Division soil standards for cleanup. TDEC felt that Jeffrey Chain had adequately delineated contaminated soils and had removed all contaminated soil in the sump. Also, the sump was covered with an asphaltic cover. The letter noted that groundwater sampling had identified several volatile organic compounds (VOCs) not associated with petroleum contamination in many wells; however, TDEC "feels that their presence may indicate an off-site origin" because of the presence of VOCs in upgradient wells and their failure to identify these VOCs in the facility's manufacturing process (Ref. 9).

- March 1997** Strata prepared a *Remediation Plan* for Jeffrey Chain detailing the intent to continue groundwater sampling for four additional quarters (Ref. 32, p. 3-4).
- May 27, 1997** TDEC decided that no further action was required for "contamination stemming from the former use of a water-soluble cutting oil sump on site" (Ref. 10). TDEC based the decision on TPH concentrations in soil and groundwater being below 250 and 1 ppm, respectively. The groundwater beneath the site was also considered to be a non-drinking water supply because of its position downgradient from groundwater wells. TDEC felt that any groundwater contamination present adjacent to the former disposal area had not migrated, and that "natural attenuation is evidently adequate to prevent migration with the local groundwater flow" (Ref. 10).

### 2.3.2 Major Investigations

On March 8, 1991, TDHE prepared a PA for Jeffrey Chain (Ref. 3). The report identified Jeffrey Chain as a threat to groundwater and noted the potential that 19,000 people could be affected by the contaminated groundwater underneath the site (Ref. 3, p. 6). Sampling prior to the PA detected ethylbenzene, toluene, xylene, chromium, barium, 1,1,1-TCA, 1,2-DCE, and PCE in groundwater and soil (Ref. 3, pp. 7, 11). TDHE recommended the site for an SSI to further evaluate it for placement on the National Priorities List (NPL) (Ref. 3, p. 8). The groundwater threat was based on the possibility that Jeffrey Chain could contaminate Havley Springs, a potable water source for Morristown, north of the site (Ref. 3, p. 8). Although the Havley Springs source may originate from groundwater (upgradient from site), municipal water is drawn from the Havley Springs reservoir, a surface water resource (Ref. 5, pp. 23, 31).

In March 1991, Tenera prepared a *Groundwater Monitoring Report* for Jeffrey Chain including groundwater data from 1990–1991. A total of 15 monitoring wells were sampled at least twice in the 2-year period: 4 wells around the former disposal pit, 4 wells at a radius of 200 feet from the pit, 6 wells along the site border, and 1 well located immediately downgradient of the disposal pit approximately 75 feet away (see Figure 3) (Ref. 29, p. 1). Samples were analyzed for organic parameters only; no metals analysis was performed. Table 1 provides the maximum concentrations of contaminants during the groundwater monitoring period. Guidance values are provided for comparison (Refs. 33, 34). The data shows that benzene, toluene, cis-1,2-DCE, PCE, and 1,2,4-trimethylbenzene were elevated compared to guidance values. No background concentrations were established for this study. TPH concentrations during the monitoring period exceeded the groundwater standard for the state of Tennessee; however, there is no federal TPH standard.



JEFFREY CHAIN CORPORATION

EPA ID No. TND987776952

Morristown, Hamblen County, Tennessee

FIGURE 3 - 1990-1991

Groundwater Monitoring Sampling Locations



T N & Associates, Inc.  
Engineering and Science

Copied from Tenera, L.P.,  
Groundwater Monitoring Report. March 1991.

TABLE 1

## 1990-1991 Groundwater Monitoring Maximum Contaminant Levels

Analyte (µg/L)	Bordering the Disposal Pit				200 Feet from Disposal Pit				Along the Site Perimeter							Guidance
	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MCL	
TPH	1,200	500	157,000	4,000	13,500	--	5	6	7	9	360	--	--	2,300	--	1,000*
Benzene	--	--	--	--	--	--	--	--	--	70	--	--	--	--	--	5
Toluene	--	--	--	--	--	--	--	--	--	71	--	--	--	54	--	1,000
Xylene	6	--	120	7	--	--	--	--	--	16	--	--	--	14	--	10,000
Ethylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	700
Naphthalene	--	--	--	--	--	--	--	--	6	5	--	--	--	--	--	6.2*
1,1,1-Trichloroethane	--	--	--	--	--	--	--	10	--	--	--	--	--	--	--	200
Cis-1,2-Dichloroethylene	16	--	140	58	14	--	--	--	35	--	--	--	--	--	7	70
Tetrachloroethene	--	--	--	--	--	--	--	24	--	--	--	10	--	--	--	5
1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--	13	--	--	--	--	--	12*

Notes: Shaded cells indicate concentrations exceeding guidance values; no background samples designated.

MW Monitoring well

MCL National Primary Drinking Water Standards Maximum Contaminant Level

TPH Total Petroleum Hydrocarbons

-- Non-detect

\* Tennessee Department of Environment and Conservation, Division of Underground Storage Tanks TPH closure goal

a EPA Region 9 Preliminary Remediation Goals for tap water (no MCL determined).

On September 6, 1994, B&V prepared an SI report for EPA. B&V collected surface, subsurface, and groundwater samples during the investigation (see Figure 4) (Ref. 5, p. 7). Samples were clustered around the former disposal pit to determine current levels of contamination, the southeastern border to determine background conditions, along the western edge of the property to determine if contamination was present, and along a drainage ditch on the northern end of the property to determine if contamination was present at this location (Ref. 5, pp. 10–11). The drainage ditch runs from the rear of the property around the eastern side of the facility to the front of the site (Ref. 5, p. 14). Two private wells were also sampled off site to determine if on-site contamination had spread and affected off-site wells (Ref. 5, p. 11). The results of surface soil sampling identified two locations with contaminant concentrations elevated compared to background. Elevated is defined as meeting or exceeding three times a background concentration, or meeting or exceeding the detection limit of a non-detect background result. The results are presented in Table 2 with guidance values provided for comparison. Soil sampling identified the drainage ditch as the only area with contamination. B&V considered the drainage ditch to be the only remaining on-site source. B&V did not give a specific source for the contamination in the drainage ditch; however, water flowing from the rear of the facility could have affected soils in that area. No subsurface soil contamination was identified.

**TABLE 2**  
**1994 Surface Soil Sampling Results**

Analyte (µg/kg)	Background	West of Disposal Pit	Drainage Ditch		Guidance
	SS-1	SS-2	SS-4	SS-5	PRG
Barium	150	95	78	<b>480</b>	100,000
Calcium	810	2,200	<b>140,000</b>	1,900	—
Copper	6.1	17	<b>40</b>	7.6	76,000
Lead	34J	21	<b>150</b>	60	750
Magnesium	410	720	<b>31,000</b>	470	—
Manganese	3,600	1,500	860	<b>11,000</b>	32,000
Nickel	7	19	<b>34</b>	11	41,000
Sodium	<20	19	<b>58</b>	18	—
Zinc	26	41	<b>2,900</b>	34	100,000
Bis (2-ethyl-hexyl)phthalate	<400	--	<b>3,000</b>	--	180
Acetone	<0.013	--	--	<b>0.2J</b>	6,200
4,4-DDT	<4.3	--	<b>5.3</b>	--	12,000
Gamma-Chlordane	<2.2	--	<b>3.4</b>	--	11,000
Alpha-Chlordane	<2.2	--	<b>3.0</b>	--	11,000

Notes: Bold values indicate concentrations elevated compared to background.

Shaded cells indicate concentrations exceeding guidance values.

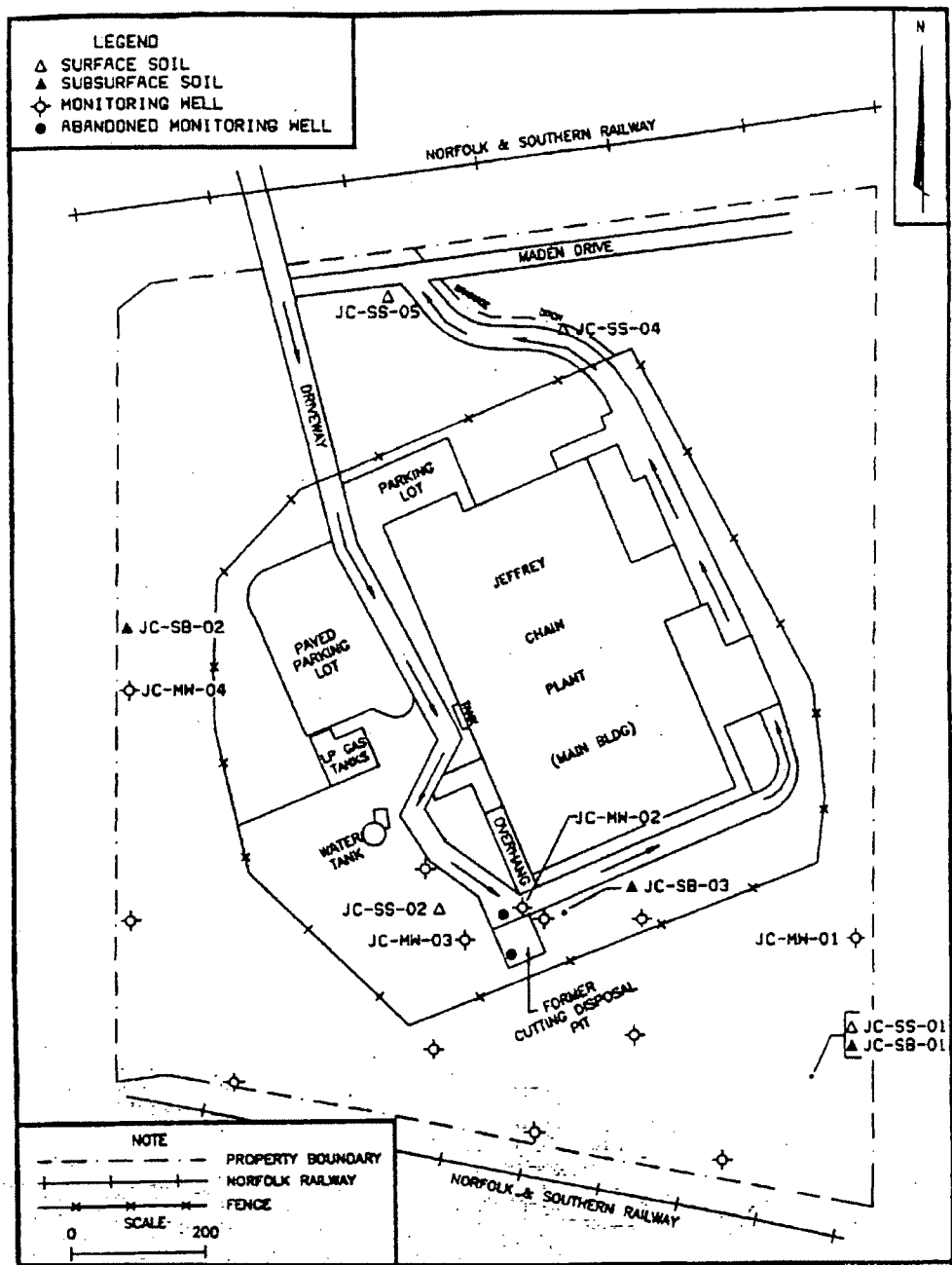
PRG EPA Region 9 Preliminary Remediation Goal for industrial soil

— No standard exists for this compound

-- Non-detect

< Non-detect; Value provided is detection limit

J Estimated value



JEFFREY CHAIN CORPORATION  
 EPA ID No. TND987776952  
 Morristown, Hamblen County, Tennessee

FIGURE 4 - 1994 Sampling Locations



T N & Associates, Inc.  
 Engineering and Science

Copied from Black & Veatch Waste Science, Inc.,  
 Site Inspection Report. September 6, 1994.



All groundwater samples contained elevated levels of contaminants compared to the background well, MW-01, located on the southeastern corner. Table 3 provides the analytical results for groundwater sampling along with guidance values for comparison (Refs. 33, 34). Two off-site, private wells were sampled during the investigation. The private wells are 265–285 feet deep and their comparison to MW-1 (85 feet deep) is limited. One well contained elevated levels of zinc and the report identified Jeffrey Chain as the possible source (Ref. 5, p. 25). Jeffrey Chain denied this allegation because the levels of zinc in the private well were 30 to 40 times higher than any detection on site and the casing for the well was galvanized steel, a zinc-containing alloy (Ref. 2, p. iv). The well may also have been completed in the Mascot Dolomite, a layer used in Jefferson City (10 miles southwest) for zinc mineralization (Ref. 2, p. iv). Since the area is karst, rapid flow of contaminants can occur. B&V found the groundwater to be a major concern but identified only a limited amount of targets for the pathway (Ref. 5, p. 24). Lead and iron were detected above MCLs; however, neither iron nor lead were identified as contaminants of concern prior to 1994. Lead was detected in the groundwater at elevated levels compared to guidance values in two locations on site. Both occur west of the disposal area and are almost twice the federal MCL. It appears that a groundwater plume consisting of lead could exist between the former disposal pit and the western border. However, without more analytical data from the area between the two wells, it is impossible to tell exactly how large an area is affected. PCE, detected by Tenera during groundwater monitoring from 1990–1991, was identified in the background well only.

**TABLE 3**  
**1994 Groundwater Analytical Results**

Analyte (µg/L)	Background	North of Disposal Pit	West of Disposal Pit	Western Border	Private Wells <sup>+</sup>		Guidance
	MW 1	MW 2	MW 3	MW 4	PW 1	PW 2	MCL
Aluminum	2,000	630	12,000	36	--	33J	36,000*
Barium	21	75	93	43	22	21	2,000
Chromium	<8	--	48	--	--	--	100
Iron	2,900	1,000	<b>29,000</b>	4,400	--	170	11,000*
Lead	8	--	<b>29</b>	<b>27</b>	--	3	15
Manganese	53	190	300	290	--	4	880
Nickel	<15	81	18J	--	--	--	730
Potassium	1,700	6,400	5,500	1,900	1,400	1,600	--
Sodium	5,600J	12,000J	17,000J	5,900J	2,800J	--	--
Vanadium	<9	--	29	--	--	--	260
Zinc	<6	28	45	--	--	1,800 <sup>+</sup>	11,000
1,2-DCE (total)	<10	20	3J	--	--	--	100 <sup>a</sup> / 70 <sup>b</sup>
Xylene	<10	12	4J	--	--	--	10,000

Notes: Bold values indicate concentrations elevated compared to background.

Shaded values indicate concentrations exceeding guidance values.

MW Monitoring well.

MCL EPA National Primary Drinking Water Standards Maximum Contaminant Level

\* EPA Region 9 Preliminary Remediation Goal for tap water (no MCL determined)

+ Although B&V compared the private wells to MW-1, the differences in depth and well type limits this type of comparison

a MCL value for trans-1,2-DCE

b MCL value for cis-1,2-DCE

-- Non-detect

— No standard exists for this compound

In August 1996, Strata provided a summary of groundwater analytical results from January 1990–January 1996 (Ref. 8). The full summary is provided as Appendix A to this report. Table 4 provides the analytical results for January 1996. MW-1 is the background well and guidance values are provided for comparison. Only TPH, benzene, cis-1,2-DCE, and PCE were analyzed for. Metals analyses occurred last during the 1994 TDEC SI. Compounds detected in the past, such as xylenes or lead, were not analyzed for. After the 1996 summary of groundwater data, no other sampling events were documented in the site file. No further action has been taken at Jeffrey Chain since 1997 when TDEC decided to close the site out based on UST closure goals (Ref. 10).

**TABLE 4**  
**1996 Analytical Results for Groundwater VOC Analysis**

Analyte (µg/L)	Background	50 feet SW of Disposal Area	Wells Surrounding the Disposal Area between 150–600 Feet from MW 1					Guidance
	MW 5	MW 1	MW 7	MW 9	MW 13	MW 14	MW 15	MCL
Benzene	<5.0	--	--	--	--	--	--	5
Cis-1,2-DCE	<5.0	5.1	8.8	--	--	--	--	70
Tetrachloroethene	<5.0	--	--	--	--	--	--	5
TPH	<500	2,000	2,000	3,000	<500	<500	<500	—

Notes: Bold values indicate concentrations elevated compared to background

MW Monitoring well

MCL EPA National Primary Drinking Water Standards Maximum Contaminant Level

< Non-detect; value provided is the detection limit

-- Non-detect

TPH Total Petroleum Hydrocarbons

— No federal standard exists

## 2.4 SOURCE AREAS

The original source consisted of a gravel-lined pit on the southwestern corner of the facility. Waste-cutting oil and hazardous compounds were discharged to this pit from 1979–1988 (Ref. 3, p. 1). An estimated 21,000 gallons of wastes were dumped in this area, mainly machinery coolant based chemicals (Ref. 35). The contamination of soil in the pit led to contamination of the groundwater underneath the site. Soil sampling determined that the soil in the pit contained ethylbenzene, toluene, xylene, chromium, and barium (Ref. 3, p. 7). Over 2,500 yd<sup>3</sup> of contaminated soil was excavated from site in 1989 and 1990, primarily from the pit and the scrap metal storage areas. Confirmation samples collected from the pit excavation documented the removal of most contamination; however sample 4-24 (35–40 feet in depth) identified concentrations of naphthalene [33 micrograms per kilogram (µg/kg)], xylene (73 µg/kg), ethylbenzene (10 µg/kg), toluene (5 µg/kg), and PCE (6 µg/kg) (Ref. 3, pp. 2-2, 2-5).

Groundwater sampling from 1994 identified elevated levels (compared to background) of aluminum, barium, chromium, iron, lead, manganese, nickel, potassium, sodium, vanadium, zinc, 1,2-DCE, and xylene (Ref. 5). Only lead [29 micrograms per liter ( $\mu\text{g/L}$ )] exceeded any MCL guidance value.

Groundwater monitoring in 1995 and 1996 analyzed for TPH, benzene, toluene, cis-1,2-DCE, and PCE. Only cis-1,2-DCE was identified as elevated compared to background, and no concentrations exceeded drinking water standards (Ref. 8). No subsequent sampling events were present in the file material for Jeffrey Chain.

The 1994 SI documented the removal of contaminated soil, but it identified the drainage ditch on the northwestern corner of the facility as a source of contamination. Surface soil samples from the ditch identified barium, copper, lead, magnesium, manganese, nickel, zinc, bis (2-ethylhexyl) phthalate, acetone, 4,4-DDT, gamma-chlordane, and alpha-chlordane as elevated compared to background (Ref. 5). No subsurface soil or groundwater samples were collected in this area, and the ditch is estimated to represent approximately 200 square feet ( $\text{ft}^2$ ) of contaminated soil. TDEC decided in 1997 to have no further action at the site because contaminant levels were below the UST division cleanup goals (Ref. 10).

Although a significant removal occurred, certain previously identified (1994 and prior) elevated contaminants (lead, iron, and zinc) that exceeded drinking water standards were not analyzed for in subsequent groundwater monitoring events (1995 and 1996). Since these contaminants may remain, all previously identified source compounds not demonstrated below drinking water standards in groundwater are considered for scoring. Source compounds used in scoring are barium, iron, lead, magnesium, manganese, nickel, zinc, bis (2-ethylhexyl) phthalate, acetone, 4,4-DDT, gamma-chlordane, alpha-chlordane, naphthalene, xylene, ethylbenzene, and PCE (Refs. 3, pp. 2-2, 2-5; 5).

### 3.0 PATHWAYS

This section discusses all pathways and details the targets associated with evaluated pathways. Only the groundwater migration and soil exposure pathway were evaluated. The surface water and air migration pathways are briefly discussed below but were not evaluated.

### 3.1 GROUNDWATER MIGRATION PATHWAY

The groundwater migration pathway is of concern at Jeffrey Chain due to the elevated levels of several hazardous compounds in excess of drinking water standards, as well as the possible contamination of a private well. Lead, iron, zinc, 1,2-DCE, and xylenes were all identified at elevated levels compared to background in 1994 (Ref. 5). Only iron and lead exceeded drinking water standards on site. A high concentration of zinc (1.8 ppm) was identified in a private well approximately 1 mile south of the site; however, its concentration of zinc is significantly higher than any concentrations ever found on site but still below the MCL of 5 ppm (Refs. 5, 34).

In April 1994, Jeffrey Chain began analyzing groundwater for only TPH, benzene, cis-1,2-DCE, and PCE (Ref. 11, p. 2-6). After eight consecutive quarters, no VOCs were detected above MCLs (Ref. 11, p. 6-1). In May 1997, TDEC acknowledged the reclassification of the site groundwater as a "non-drinking water supply" and determined that "no further action is required" at the site (Ref. 10).

Groundwater targets within 4 miles of Jeffrey Chain are limited. Municipal water is provided to Morristown from surface water intakes along Cherokee Lake and Havley Springs (Ref. 36). Morristown Utility serves approximately 30,000 people (Ref. 36). Morristown Utility sells its water to four other utility districts: Alpha Talbott, Russellville-Whitesburg, Bean Station, and Witt. Alpha Talbott provides water to approximately 14,500 residents (Ref. 37). Russellville-Whitesburg supplies water to 14,750 people (Ref. 38). Bean Station supplies 5,000 people and Witt supplies 4,200 (Refs. 39, 40). A total of 97 private wells are also present within 4 miles of the site (Ref. 41).

Table 5 lists the groundwater receptors for the Valley and Ridge aquifers within 4 miles of the site in Morristown, Tennessee. It also illustrates the apportioned populations associated with each well and the total populations identified within each radial ring (Ref. 1). The population per well was based on each private well serving a single residence and each residence having an average number of people of 2.5. A total of 234 people are estimated to obtain their drinking water from private groundwater supply wells.

**TABLE 5**  
**Valley and Ridge Aquifer System Groundwater Receptors**

Radial Distance (Miles)	Municipal Water Systems	Number of Active Wells	Population per Well <sup>a</sup>	Total Population Served per Radial Distance
0-0.25 Mile	--	0	0	0
0.25-0.5 Mile	--	0	0	0
0.5-1 Mile	Private Wells	7	2.5	18
1-2 Miles	Private Wells	17	2.5	43
2-3 Miles	Private Wells	33	2.5	83
3-4 Miles	Private Wells	40	2.5	100

-- No wells in area

a Wells were assumed to serve one household at 2.5 people per household (Ref. 41)

### 3.2 SURFACE WATER PATHWAY

The surface water pathway is of minimal concern at Jeffrey Chain. A drainage ditch leading from the rear of the property to the front of the property ends at Maden Drive. The pathway could only extend from there by overland flow to a sinkhole depression located across the street to the northwest (Ref. 2, p. 3-7). All surface water in the immediate vicinity enters sinkholes (Ref. 1). Since no pathway to a perennial water body was identified, no Target Distance Limit or Probable Point of Entry could be determined.

### 3.3 SOIL EXPOSURE PATHWAY

The soil exposure pathway is of some concern at Jeffrey Chain. Although contaminated soil identified in 1988 has been excavated and the resulting backfilled area paved over, B&V identified a second area in 1994. The drainage ditch on the northern end of the facility contained elevated levels of barium, copper, lead, magnesium, manganese, nickel, zinc, bis (2-ethylhexyl) phthalate, acetone, 4,4-DDT, gamma chlordane, and alpha chlordane compared to background concentrations. Only bis (2-ethylhexyl) phthalate [3,000 milligrams per kilogram (mg/kg)] exceeded its Industrial Soil Preliminary Remediation Goal (PRG) guidance value of 180 mg/kg (Refs. 5, 33). No remediation for this area was documented. The area of contamination is estimated to be 200 ft<sup>2</sup> based on two sampling points in the drainage ditch; assuming at a minimum there is a 1-foot strip of contaminated soil between the two collection points and a distance of 200 feet. A maintained fence surrounds the site. Only 2 people live within 0.25 miles of the site, 175 between 0.25 miles and 0.5 miles, and 1,909 between 0.5 miles and 1 mile (Ref. 42). Approximately 150 workers are employed at Jeffrey Chain (Ref. 5, p. 29). No sensitive environments exist on site, and a limited number of targets lie within 1 mile of the site.

### **3.4 AIR PATHWAY**

The air pathway is of minimal concern at Jeffrey Chain and was not evaluated. No air samples have been collected and no evidence exists to suggest any type of threat.

## **4.0 CONCLUSIONS AND RECOMMENDATIONS**

Jeffrey Chain manufactures industrial conveyor-type chain. Waste cutting oil, metal sludge, and hazardous wastes were dumped into a disposal pit on the southwestern corner of the facility. Approximately 21,000 gallons of materials were disposed of in the pit from 1979–1988 when TDEC ordered Jeffrey Chain to discontinue its disposal activity there. Soil and groundwater sampling identified several hazardous materials including aluminum, barium, chromium, iron, lead, manganese, nickel, potassium, vanadium, zinc, 1,2-DCE, PCE, and xylenes. Jeffrey Chain excavated the soil in the pit and began a passive remediation system collecting oil from the groundwater. The excavated area was backfilled, and an asphalt cap was placed over the area. Levels of contaminants in groundwater were still elevated compared to background in the 1994 SI. The SI also identified an area of contaminated soil on the front of the property located in a drainage ditch originating from the rear of the facility. Since this area of soil contamination and contamination in the groundwater were below Tennessee cleanup standards, no further action was recommended by the State in 1997. Elevated levels (compared to background) of contaminants may still be present on site, but none were documented in the most recent groundwater sampling event (1996) to exceed groundwater or soil standards.

A review of the file material and updated target populations failed to generate an appreciable HRS score, even when actual contamination (zinc) of a private well is considered. The overall low number of groundwater and soil targets limited the HRS site score. Based on the low HRS score and significant remedial actions already performed, a No Further Remedial Action Planned (NFRAP) recommendation is currently recommended.

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